

The combination of author and subject in this paper is powerful medicine. A prospect and proposal for the eradication of tuberculosis in the United States are presented and the necessary conditions are discussed. The author raises a number of penetrating questions that range beyond tuberculosis, and relate to broader aspects of public health.

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PROBLEMS TO BE SOLVED IF THE ERADICATION OF TUBERCULOSIS IS TO BE REALIZED

Fred L. Soper, M.D., Dr.P.H., F.A.P.H.A.

IT WAS only six years ago, at Kansas City, that the American Public Health Association, for the first time, passed a resolution in support of the concept of eradication in the prevention of communicable diseases. In the six years that have elapsed since the first acceptance of eradication we have advanced such a tremendous distance that it is now possible to discuss the eradication of such a difficult problem as tuberculosis. Our discussion is related to the eradication of what has been and is, probably, the most widespread of human ills, the most chronic and persistent of infections, with the longest period of infectivity of any disease, and the disease whose prevention most clearly depended, until recently, on the improvement of social and economic conditions. The very fact that this session is held will force public health workers everywhere to consider the possibilities of eradicating not only tuberculosis, but surely a host of the lesser ills of mankind.

Although I am innocent of direct participation in tuberculosis prevention, I have had long association with eradication projects dating back some 40 years. Not all of these projects have

been successful but I have no regrets over having promoted and participated in them; rather, I have felt remorse for not having undertaken and executed some of them much earlier and before decisive action was forced by destructive epidemics.

In preparing for our discussion I re-read and thrilled anew to Carroll Palmer's paper on Tuberculosis: "A Decade in Retrospect and in Prospect" prepared at the time of the tenth anniversary of the WHO in 1958.¹ I quote, "The new challenge for tuberculosis control during the next decade is, therefore, to determine what can and should be done in the increasing number of countries in which the disease can no longer be regarded as a major public health problem. . . . In countries where great progress has already been made, tuberculosis work in the future will certainly differ from what it has been in the past. Not the least of the differences will be a change in objective from control to eradication. At long last, it is not only possible but, I believe, obligatory to set the goal at eradication and not at some intermediate stage connoted by the term 'control'. . . ."

We are here to discuss how in a specific country, the United States, in which "great progress has already been made, tuberculosis work in the future" should "differ from what it has been in the past." If Palmer in 1958 believed it to be obligatory to set the goal at eradication, surely, we in 1961, with three years' additional testing of the tools we have for the job, do not, in conscience, have any choice in the matter. Palmer recognized the supreme importance of the struggle to zero. He said, "Although reductions in mortality, morbidity and infection rates may appear most dramatic in areas in which the present rates are still high, of fundamental importance to tuberculosis workers throughout the world will be the smaller reductions in low prevalence areas, because such reductions will reflect the development of successful methods for pinpointing and eradicating the last remaining sources of infection." As Palmer clearly foresaw, the outcome of the war to free the human race from tuberculosis depends now on the development of successful mopping-up methods, once the incidence of the disease is at a very low level; tools and technics are already available for the campaigns for the reduction of mass infection, even in the most heavily infected populations.

I have thrilled also to the challenge issued, later in the same year (1958), by James Perkins for a "firmly concentrated program of eradication of tuberculosis from the whole face of the earth!"² Perkins defined "eradication of tuberculosis" as the "ultimate goal of having no human being on this earth react significantly to a skin test with a proper dosage of a standardized tuberculin; in other words, total bacteriologic eradication. . . ."

This apparently overly bold and brash challenge loses these characteristics to one who has seen miracles in his lifetime and is familiar with the present

program for the eradication of malaria on a global scale.

The important papers of Palmer and Perkins were followed by the truly remarkable Arden House Conference on Tuberculosis the next year (November 29, to December 2, 1959). The Arden House Report signalizes the transformation of tuberculosis from a social and economic to a public health, medical, and administrative problem and recommends its direct therapeutic solution.

Problems to Be Solved

Experience with other eradication projects suggests that there are many and various problems to be solved in the eradication of such a widespread chronic infection as tuberculosis—psychological, technical, administrative, educational, and financial in nature. The previous measure of these problems is difficult but the solution of entire groups of them may depend on decisions on a few basic points.

Among these points, if the ready eradication of tuberculosis to be realized, I would put the following:

1. Definition of eradication as an absolute goal; acceptance by the national and state health authorities and by interested voluntary agencies of eradication, thus defined, as a feasible and urgent objective.
2. Acceptance of tuberculosis as no longer essentially a social and economic but rather a public health and medical administrative problem; establishing the responsibility of the community to the infected individual; but also establishing the responsibility of the infected individual to uninfected persons.
3. Provision for a national coordination authority to stimulate through the state health services eradication programs in each of the 3,152 counties in the country, backed by technical, epidemiologic, educational, administrative, and financial support where needed; preparation of a national plan for TB eradication, preferably coordinated with similar national plans for Canada and Mexico.
4. Training of professional staff in the eradication concept of disease prevention;

standardization and simplification of procedures to facilitate the training of nonprofessional staff in the routine identification, registration, supervision, and surveillance of infected persons and their intimate contacts.

Acceptance of Eradication of Tuberculosis as a Feasible and Urgent Objective

Although the decision to accept the absolute definition of eradication as the objective of the tuberculosis program is inevitable, it is important that this decision be ratified as soon as possible by all services and agencies participating in tuberculosis prevention.

The acceptance of the concept of eradication in place of control (reduction) forces a radical psychological and administrative change in attitude toward the existence of low-incidence tuberculosis in the community. This change is based on the fundamentally different objectives of control and of eradication.

The objective of control is to reduce the incidence of a given disease to a low level and to maintain this low level forever.

The objective of eradication is completely to eliminate the possibility of the occurrence of a given disease, even in the absence of all preventive measures. This definition, modified by the phrase "unless reintroduction occurs," applies also to local area, state, national, and regional eradication.

In control, one may glory in the percentage reduction of disease incidence, where as in eradication any reduction short of the absolute leaves one preoccupied with the seeds of infection that remain.

In control, one may measure progress from the high point on the curve of incidence downward, i.e., what has been done; in eradication one measures always from the base line of the chart upwards, i.e., what remains to be done.

In control, one tends to lose interest in a disease at the point where, in eradication, many times, the greatest difficulties are encountered.

In control, one may plan on a small local scale, for limited areas; in eradication, one must plan for a program of sufficient scope to minimize, from the beginning, the threat of reinfection from the periphery; in eradication there is no stopping point, no rest period. Eradication must continuously expand at the periphery until all points from which reinfection may occur have been cleared.

In control, one must count the cost as part of continuing unending annual budgets; in eradication, one may capitalize future savings over an indefinite period against the peak costs of the years required for eradication. "Virtual eradication" never merits the full premium of the effort expended; so long as some tuberculosis remains the threat of recrudescence exists and the cost of the control effort must continue. Truly may it be said, "To toil ye have the right, but not to the fruits thereof."

In control, one may disregard the rights of the minority, of those living in sparsely settled areas of difficult access, and take advantage of population distribution to give a low per capita cost and an over-all low rate of incidence.

Eradication cannot sacrifice the minority under the blanket classification—"no longer of public health importance." Eradication cannot be made available to part of the people; protection of all the population becomes the only acceptable professional public health standard.

In control, some cases and a few deaths are permissible; in eradication, "any is too many." (Note the singularity of the verb!)

When the public health officer ceases to glory in the partial reduction of disease incidence (control) and accepts the

philosophy that in taking credit for any reduction, he accepts responsibility for the residuum, a long step has been taken toward eradication. When the public comes to know that a given communicable disease is completely preventable, another considerable advance has been made.

The proper definition of eradication and the only one which clearly distinguishes it from control goes back to the translation of its Greek roots, "out by the roots." Eradication has no meaning except as an absolute, without modifying phrases or limiting adjectives. For administrative convenience one may speak of area, state, national, continental, and regional eradication programs as steps in global eradication, but never of "partial eradication," "virtual eradication," or "eradication as a public health problem!"

The acceptance of eradication as thus defined, as the objective of the Tuberculosis Prevention Program, has the advantage of giving a definite end point against which all progress is measured.

The acceptance of eradication as the objective leads inevitably to careful epidemiological studies as the end point is approached, when basic facts, not previously known, may be more readily uncovered. Thus, acceptance of the challenge of eradication leads to the discovery of facts which are needed to bring about eradication. In eradication, one learns what the final difficulties are going to be and their solution through study, while eradicating.

The mathematician knows that geometrical regression based on a continued vital index of less than one may be as destructive for a species as geometrical progression based on an index greater than one is favorable to its perpetuation. But the regression curve in many instances cannot be blindly projected down to the zero. Actual experience does not indicate that the factors which effect the gross reduction of

an infection will be necessarily effective at the lowest levels of infection. The reduction of *Aedes aegypti* breeding in the key centers of yellow fever infection in the Americas resulted repeatedly in the practically complete disappearance of yellow fever from the statistics of the continent. Eventually, the chasing and suppression of reported outbreaks was superseded by the routine systematic collection of post-mortem material from fever cases over large areas of South America. This so-called viscerotomy revealed two entirely different and unrecognized mechanisms not affected by the anti-aegypti campaign by which yellow fever maintained itself during its silent nonepidemic periods; viz., silent endemic rural yellow fever transmitted by *A. aegypti* in a semi-arid region and jungle yellow fever among the forest animals.

The phenomena of the hidden focus of infection, of the unrecognized method of transmission and of the relative increased importance of confusing observations may be very real problems as incidence falls. They have led to the terms, "the epidemiology of a disappearing disease," "the epidemiology of a retreating disease," and "the epidemiology of an evanescent disease." They have been and promise to be an important consideration in the eradication of malaria from the world. That this epidemiology of a disappearing disease concept is important is borne out by experience with brucellosis.³

"The brucellosis eradication program in many parts of the country has reached such an advanced stage that certain problems inherent in dealing with the vestiges of a once widespread infection are coming more and more into prominence.

"It is a truism that the last residue of infection in a population behaves more erratically in regard to ordinary diagnostic reactions than does a group where no check has ever been applied

to the infection previously. This has been the experience in all situations where an infectious disease has been brought under control, as in the cases of bovine tuberculosis and human syphilis and the problem of false tests has assumed proportions it never had when the infections were widespread."

In tuberculosis eradication, it is obvious that as the number of persons infected with the tubercle bacillus declines, the specificity of the tuberculin test will fall, percentually, since non-specific reactions will chiefly be found.

It is possible that the epidemiology of a disappearing disease differs from the usually recognized epidemiology of that disease only because there are somewhat varied mechanisms of transmission or maintenance of the infection of varying importance when there is no attempt at control. Counter measures are obviously directed against the most common mechanism and these measures may be relatively inefficient against less common and unusual mechanisms. These, in turn, may not be sufficiently important to come under scrutiny in a control program because the disease ceases to be a public health problem before they become apparent. One cannot know then whether the long-term downward trend would have continued to regress to zero had tuberculosis continued subject only to the previous pressures; nor can one affirm or deny that the present regression curve will proceed smoothly to zero and not flatten out due to resistance to therapy, to the inability to discover certain foci of transmission, or to other factors. It is only as the pressure drive of eradication is exerted accompanied by careful epidemiological studies that we shall know the answer. The fact that there are already some areas in which all transmission has been blocked suggests that the present tools are sufficiently sharp to preclude any important flattening of the curve on the downward drive.

Acceptance of Eradication as Public Health Administration Problem with Reciprocal Community and Individual Responsibility

The public health worker and the public long have been conditioned to the acceptance of tuberculosis as a chronic disease, that one did or did not have, that one did or did not die of, and that depended on social and economic factors for its solution. To visualize the importance of getting a proper image of tuberculosis before the public, it is only necessary to imagine the reaction were 12,000 people to perish in the United States in 1961 from another febrile hemorrhagic disease, namely, yellow fever. Every one knows that yellow fever is preventable, but not everyone knows that no one has to get tuberculosis.

It is important, if eradication of tuberculosis is to be readily realized, that the public health worker and the public reclassify tuberculosis in the terms of the State Board of Health of New York State in 1899, as a dangerous, infectious, and communicable disease. To this classification must be added "preventable," "easily preventable" or "completely preventable."

The public health worker has been grouped with the public in this statement because the public cannot be expected to go ahead of the public health worker. Striking examples of the present attitude of the public health worker toward tuberculosis are to be found in the reports of two committees appointed by the Public Health Service following the Arden House Conference, the one on Goals and Standards, the other on Case Detection Evaluation. The recommendations of these reports may be reasonable in the light of past performance and present capacity of tuberculosis control services but are not compatible with responsibilities inherent in the present situation.

Tuberculosis has become a public health administrative problem through the development of adequate means to identify infected and infectious persons and, for the first time in the long history of tuberculosis prevention, knowledge of and experience with efficient chemotherapeutic drugs. These drugs are both curative and prophylactic; also, although treatment is prolonged, most cases become noninfectious during treatment. Treatment is cheap, simple, is taken by mouth, does not require close medical supervision, and may be taken at home and during continued employment. Physical isolation in sanatoriums is now being replaced by chemical isolation under normal living conditions. The prevention of transmission is possible without disrupting the lives of infected and infectious individuals. Surely the community through its public health service has a responsibility to prevent the transmission of tuberculosis.

Chemotherapy has become a public health measure not only through the cure of open cases and rendering such cases noninfectious during the necessarily prolonged period of treatment, but also by the prevention of infection of contacts of infectious cases. The community cannot discharge its responsibility to its people unless active cases are found and are placed under treatment for the necessary period. It is important, then, in the public interest, that infected individuals, infectious cases, and their intimate contacts be identified, and, where indicated, be given curative or prophylactic therapy. The community should be responsible for making available to all residents, including transients, diagnostic and therapeutic services, either directly or through local hospitals and practicing physicians, under the supervision of the health authority. The community should also, where needed, offer the benefit of social service and rehabilitation to victims of tuberculosis and their families.

In synthesis, the community must in its own self-interest make the diagnosis, care, and supervision of persons infected with tuberculosis as attractive as possible.

But the community cannot discharge its responsibility without the acceptance by each citizen of his individual and family responsibility regarding tuberculosis and its transmission.

Ways and means must be found to make the individual responsible for not transmitting tuberculosis infection to any other individual. The discharge of this responsibility will, necessarily, involve periodic testing for infection and infectivity and acceptance of supervised treatment where indicated.

Having accepted the classification of tuberculosis as a dangerous, infectious, communicable, and preventable disease, it is obvious that the untreated open case of tuberculosis is a menace to the community and should merit the same type of interest of public health authorities as does the typhoid carrier. The community is justified in taking such measures as may be required to prevent the dissemination of the infection.

Given the importance of tuberculosis eradication would it not be justified to require that each individual determine periodically whether he is or is not infected with tuberculosis and if infected register for supervision by the health authorities? If Minnesota can tuberculin test all cattle every two years in its programs for the eradication of bovine tuberculosis, can one refuse to consider whether Minnesota's calves are worthy of greater consideration than are its children?

As one of the rapidly disappearing hookworm disease workers of a past generation, I would suggest testing the efficiency of the routine sputum-culture test as an early step in high-risk groups rather than as the last step in the identification of open cases of tuberculosis. The distribution of sputum containers

could be made to the family, to the school, to the factory or other places of congregation, without the necessity of contacting each individual. The collection of specimens might even be facilitated by sending and receiving containers by post. In the hookworm campaigns of another era containers were distributed and collected for the examination of material coming from the other end of the alimentary canal, which for obvious reasons should be more difficult than the collection of sputum samples. The hookworm campaign was a mass operation and as such the examination of samples received was a routine one carried out by men trained specifically to identify hookworm and other nematode eggs. It should not be difficult to organize the mass sputum-culture examination as a strictly routine procedure involving a minimum of highly trained professional staff. Surely it will be easier than viscerotomy, the routine systematic collection of post-mortem liver tissue for the diagnosis of unsuspected yellow fever cases, already referred to. Just as viscerotomy indicated when transmission of yellow fever was occurring at the time it occurred, so can the sputum-culture test indicate where and when transmission of infection is probably occurring.

The sputum-culture test, if successful as a routine measure, will free the tuberculosis effort from a great deal of intermediate work now performed in sifting out infectious cases from among tuberculin reactors and those with suspect chest films. Used routinely, it will let the infectious case declare itself almost automatically.

National Coordination Authority: National Plan for Eradication

Once eradication of tuberculosis is accepted as a policy, tuberculosis becomes a truly national problem. Ex-

perience with eradication programs in other countries has emphasized the importance of central national operation or coordination. In the United States, as has been previously commented, the political structure is not, under normal peacetime conditions, conducive to the organization of effective eradication programs.

The need for a satisfactory mechanism for national planning and coordination of eradication efforts is not limited to the field of tuberculosis but is common to the eradication of a number of presently eradicable diseases and insect vectors. The solution of this problem is of sufficient importance that it should be given full consideration and study before action is taken. There should be consultation of those having experience in the Malaria Control for War Areas, in the Department of Agriculture programs for the eradication of bovine tuberculosis, brucellosis, and the screw-worm, and with those who may be interested in the eradication of poliomyelitis, tuberculosis, typhoid fever, syphilis, and *A. aegypti*, to mention only some of the obvious conditions crying out for eradication. The solution will be found through some mechanism taking full advantage of the strength of our city, county, and state health services, and of the unique ability of voluntary agencies in stimulating public interest and marshaling support for health programs. It is to be regretted that the MCWA, with its experience in coordinating the National Malaria Eradication Program and with its relatively large resources in personnel and financing, became the Communicable Disease Center and not the Communicable Disease Eradication Center.

The time has come for the development of a strong coordinating center for eradication efforts devoted to national eradication programs where such are indicated; the United States Congress is already conditioned to the approval

of budgets for eradication programs in the agriculture and health fields. Special budgets were provided beginning in 1947 for the National Malaria Eradication Program in the United States, and since 1957, the Mutual Security Act has carried provision for many millions of dollars earmarked for malaria eradication programs in other countries.

Tuberculosis was a local problem until eradication became possible. It is now a national problem and should be planned for on a national basis. The federal government should be responsible for the over-all national plan of eradication and for the coordination of the activities of the various states. Each state in turn must assume the responsibility for the participation of all of its cities and counties to give complete national coverage.

It has already been suggested that the community make diagnosis and treatment available and attractive to infected persons and that the individual be made legally responsible for knowing that he and his dependents are not infectious cases of tuberculosis. Accepting tuberculosis as a national problem, is it unreasonable to consider placing this responsibility on the same basis as that of the individual for knowing that he is subject to income and Social Security tax assessments and for taking the initiative of reporting his obligation and making payment? To get effective and agreeable cooperation in maintaining up-to-date reporting and registration of tuberculosis, and to facilitate maintaining infectious cases and their contacts under treatment, might not the United States government establish a system of crediting a certain amount against income tax or Social Security payments to each individual submitting annual certificates of freedom from infectiousness of himself and dependents and a somewhat larger credit for individuals with certification of having undergone an approved

period of treatment for himself or members of his family during the year? Such credits would be more than self-compensatory in identifying and getting infectious cases under treatment, in making supervision welcome, and in getting continuing registration of infected persons moving from one area to another. The credits to be established could certainly be less than the cost of searching out individual infectious cases. Such a system adopted by the federal government would be effective in getting uniform provisions for all states and much more rapid and effective in application than measures adopted by each individual state.

As the incidence of tuberculosis in the United States declines, the relative importance of infection introduced from other countries will increase. It would be highly advantageous to plan the eradication program here in conjunction with coordinated plans in Canada and in Mexico. These three countries together have a large land mass easily protected against reinfection by overland immigration; this block could exert a tremendous influence in developing tuberculosis eradication in the Western Hemisphere.

Training of Professional Staff in Eradication Concept: Simplification and Standardization of Procedures for Routine Handling by Nonprofessional Staff

It is highly important that professional staff entering in eradication programs should be given special training in the concept of eradication and in the differences in administrative approach required for eradication from that satisfactory for control. The basic differences in control and eradication have been discussed at length and these differences are reflected in the administrative techniques acceptable in each case.

There is also a real need for indoctrin-

nation of nonprofessional workers in the concept of eradication. They should understand the objective of the program and the reasons for the careful meticulous administration and the disagreeable degree of supervision of all details of an eradication operation; they should know that the big pay off comes only with absolute zero and not with "virtual eradication."

It is obvious that, given the scarcity of professional workers in the public health field, and particularly in the field of tuberculosis, any considerable expansion of the present activities must depend very largely on the possibility of using nonprofessional staff wherever possible. Each step of every procedure for identifying, diagnosing, treating, supervising, and registering infected and infectious cases and their contacts should be analyzed and broken down into those elements which require individual judgment of professional staff and those which can be executed by nonprofessional staff under supervision.

In public health administration, once procedure has been simplified and standardized, it is surprising how often it will be found that what the professional can do, he can teach the nonprofessional to do as well or even better, provided it is a routine operation not requiring judgment beyond the training of the individual.

Discussion

The decline of tuberculosis during the past decade and a half surpasses anything one could have imagined at the beginning of this period, and this with a minimal adaptation of preventive measures to the possibilities of the new era of chemotherapeutic cure and prevention of tuberculosis. It has been a period of plunging tuberculosis death rates, of an oversupply of hospital beds for tuberculosis cases, and a rapidly

falling infection rate in children and young adults. Significantly, over half of the infectious cases now being found are among elderly, previously infected persons over 45 years of age. This means that tuberculosis has been forced, just to maintain its declining position, to fall back on its capital reserves of infection deposited decades ago in the cohorts of a passing generation.

The full impact of therapy on tuberculosis has not yet been felt and much of the discussion here may seem naive a few years from now. In 1955, after an unforgettable visit to the crowded slums and to the crowded habitations and refugee quarters in Hongkong, I was surprised to find Dr. Moody, the chief of the Hongkong Tuberculosis Program, optimistic over the situation. He had found that, without increases of finance, of staff, or of hospital facilities, the number of patients certified as arrested during the year had risen sixfold in just a few years, i.e., from 500 to 3,000. Today, we know that available chemotherapy is curative in early cases, is strongly prophylactic in contacts, renders most cases under treatment noninfectious, is cheap and may be administered orally, under minimal supervision, with a wide margin of safety, at home and during continued employment. Self-medication and medication of family contacts with only occasional supervision is feasible. There are already areas in the United States in which the first stage of eradication has been accomplished, viz., the interruption of transmission to the younger generation. In addition to all this, the program for the eradication of bovine tuberculosis has brought that infection to such a low point that almost no human infections are now occurring. The only serious difficulty of chemotherapy of tuberculosis is the necessity of continued medication over a long period of time. Reading the above statements, one cannot but ask what we

are waiting for, what more must we have, what sign do we still require before assuming the responsibility for the eradication of tuberculosis? One does not have to see the end to start; but one must start if one is to see the end.

The existence of areas in the United States where transmission has been stopped has been mentioned above. These "eradicated" areas are tremendously important; they demonstrate that transmission can be prevented and set eradication as an attainable goal. From now on the public health authorities of areas with evidence of continuing transmission must be definitely on the defensive. What man has done, man can do!

The eradicated areas are important also for their power for growth. The power of growth of eradicated areas was first observed in the development of the program for the eradication of the *A. aegypti* mosquito, and has been facetiously referred to as Soper's Law of Eradication Growth. Eradication of *A. aegypti* was first observed in a number of Brazilian port cities; to protect these from reinfestation it was essential to eradicate *A. aegypti*, first in the suburbs, then further and further afield until eventually pressure built up for the eradication of *A. aegypti* in the Western Hemisphere. The islands of tuberculosis eradication should be the cherished seedbeds from which the peripheral spread of eradication is to occur. Perkins (1958) asked, "Why is it unrealistic, then, to believe that we can enlarge the perimeter of each of these small areas where tuberculosis has been eradicated, until their borders touch, and they coalesce into an ever-expanding tuberculosis free sea, which finally engulfs the last residual island, strong-holds of infection?" This is surely the process through which eradication will occur in many states but from a practical standpoint the considerable number of counties in the United

States without organized health programs and the lack of coordination of the state programs seriously hamper such a development.

In discussing the "Problems to Be Solved if the Eradication of Tuberculosis Is to Be Realized," I have assumed that we are primarily responsible for the health of the present generation and that the early eradication of tuberculosis is too important to be limited to the speed of execution possible with presently available resources. Tuberculosis eradication should not compete with infant diarrhea, cancer, coronary thrombosis, and other health problems for the given amount of money within existing budgets. Tuberculosis should be lifted from consideration as a disease of declining importance and held up to the focus of public attention as a still dangerous infection which can be blotted out. Eradication of tuberculosis if presented in a bold, decisive way by public health leaders, themselves convinced that eradication is feasible and worth while, should easily get the administrative authority and the funds for a coordinated national attack.

In a world of increasing population, a world in which intimacy and rapidity of contact between nations and regions and continents favor the maintenance of known infections and the entry and propagation in man of new disease agents, the eradication concept of communicable disease prevention has much greater importance than it had a generation ago.

The international acceptance of the eradication concept has outstripped its acceptance by the public health workers of the United States. It has, as a matter of fact, developed certain international political implications. In January, 1958, the President of the United States challenged the USSR to cooperate in programs of disease eradication, citing particularly malaria. In June of the same year, the USSR at the World Health

Assembly at Minneapolis sponsored a program for the global eradication of smallpox. In 1959, I was told in Accra that the USSR was preaching in Ghana that only under the communist form of government could malaria be readily eradicated from that country.

One of the problems facing health authorities of the American nations at the first Pan American Sanitary Conference in 1902 was the fact that quarantine in some countries was a locally administered activity with the health authorities of individual ports establishing the regulations for quarantine and their application. As local functions, these were not subject to diplomatic negotiation. The United States, as an interested shipping nation, was proposing the nationalization of this function. An analogous situation exists in the United States today with regard to communicable disease and vector eradication. Once disease and vector eradication programs become international in character, the United States government assumes certain obligations which cannot be readily discharged, since the prevention of communicable disease in the United States is a state, rather than a national, function. It is essential that the United States as a member of the Pan American and the World Health Organizations develop some mechanism through which the federal government can discharge its international responsibilities in present and future eradication programs. With such a mechanism, the United States could anticipate taking leadership in the eradication of tuberculosis.

In undertaking the eradication of tuberculosis, we are not serving only ourselves. In the failure of the United States to join in the eradication of the *A. aegypti* mosquito, it has done a great disservice to other countries which have been reinfested from ships from American ports. Worse, the United States has set the example of nonparticipation in

the first official continental eradication effort, merely because yellow fever did not seem to pose an immediate threat to our shores. It is most important to establish the precedent that, once a regional program of eradication has been determined, all nations participate whether directly threatened or not. With our high social and economic level, we may be able to afford the luxury of maintaining tuberculosis permanently; such is not the case in many other countries in which the eradication of tuberculosis could itself become a very important factor in social and economic development.

The insistence on the development of a national eradication coordinating authority and on a national plan should not deter the states, counties, and city health services from continuing and extending their present eradication programs. In the final analysis it is these local services which must eradicate tuberculosis and the experience gained and the demonstrations made by them must serve as the basis for the development of the national plan of tuberculosis eradication.

The objective of eradication is eradication and not virtual eradication, and intermediate goals can best be expressed in the number and size of areas and populations in which the complete elimination of transmission of tuberculosis is to be accomplished in a given period of time.

The goal, immediate, intermediate and final, for the tuberculosis eradication program should be the blocking of all transmission of infection from one person to another. Let us concentrate on this objective, even though we limit it initially to certain areas or population groups, however small.

Summary

Any proposal to eradicate tuberculosis in the United States, other than

by slow and uncertain attrition, should be based on:

1. Definition of eradication as an absolute; acceptance by the national and state health authorities and by interested voluntary agencies of eradication, thus defined, as a feasible and urgent objective.
2. Acceptance of tuberculosis as no longer essentially a social and economic but, rather, public health and medical administrative problem; establishing the responsibility of the community to the infected individual; but also establishing the responsibility of the infected individual to uninfected persons.
3. Provision for a national coordination authority to stimulate through the state health services eradication programs in each of the 3,152 counties in the country, backed by technical epidemiologic, educational, administrative and financial support where needed; preparation of a national plan for eradication, preferably

coordinated with similar national plans of Canada and Mexico.*

4. Training of professional staff in the eradication concept of disease prevention; standardization and simplification of procedures to facilitate the training of nonprofessional staff in the routine identification, registration, supervision and surveillance of infected persons and their intimate contacts.

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* This national coordination authority should not be an ad hoc unit devoted to the eradication of tuberculosis but, rather, a permanent agency to coordinate eradication programs for the ever-increasing number of eradicable diseases and disease vectors.

Dr. Soper, formerly director, Pakistan-SEATO Cholera Research Laboratory, Institute of Public Health, Mohakhali, Dacca, East Pakistan, is now special consultant, Office of the Surgeon General, Division of International Health, Public Health Service, Washington, D. C.

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DISCUSSION

James E. Perkins, M.D., F.A.P.H.A.

IT WAS precisely because Dr. Soper is "innocent of direct participation in tuberculosis prevention," as he words it, that he was invited to make this presentation so as to give a fresh viewpoint, albeit based upon a tremendous past experience and leadership in other eradication programs.

Dr. Soper stresses several points which he considers basic if eradication of tuberculosis is to be realized: namely, (1) acceptance by the national and state health authorities and by interested voluntary agencies of absolute eradication as a feasible and urgent objective; (2) acceptance of tuberculosis

as no longer primarily a social and economic problem, but rather a public health administrative problem, in view of the improved specific control measures currently available, particularly the antituberculosis drugs; (3) emphasis not only upon the responsibility of the community with regard to what it should do concerning the infected individual, but also upon education of the individual citizen as to his own responsibility in determining whether or not he is a menace to others, and if so, adhering to the measures necessary to prevent his transmitting his infection to others; and (4) provision for a national coordination authority for the eradication program. This implies the formulation of a national plan to be put into effect in coordination with similar plans on the state and local levels, and, ultimately, expansion of this plan on a world-wide scale starting with our adjacent neighboring countries; and reorganizing professional staff to comply with the changed requirements for an eradication program. This will require reeducation of the current professional staff in the eradication concept, determination of the skills needed for different aspects of program, and subsequent critical allocation of functions so as to conserve the limited supply of skilled personnel. Training of nonprofessional staff to carry on the less skilled tasks under adequate professional supervision will also be necessary.

Successful reorientation along these lines will not be easy. At the present time tax expenditures for the control of tuberculosis are being reduced to an increasing extent, reflecting largely the savings in the high cost of hospitalization. Yet we know from many studies, both national and local in scope, that none of the aspects of tuberculosis control are being conducted adequately throughout the country as a whole, and in few places are the recommendations of the 1959 Arden House Conference on

Tuberculosis being adequately implemented. Patients leaving the hospital following an initial period of hospitalization fail to continue adequate drug therapy. All the household contacts of new cases are not being examined for tuberculosis infection, with proper follow-up as indicated. Adequate case-finding programs are not being conducted in most communities.

It will not be easy to convince public health authorities and governmental appropriating bodies not only to stop reducing the expenditure of tax funds for tuberculosis control, but actually to increase them if eradication is to become a reality. Success will depend upon the extent to which these authorities and bodies can be convinced that spending more money for a relatively short period now will prevent spending smaller sums over an indefinite period in the future, the total of which will exceed the sum needed for an intensive eradication program for a limited period of time.

Since the control of tuberculosis in the past has been largely a reflection of improved social and economic conditions, it will not be easy to convince people we no longer have to await marked improvements in social and economic conditions in general to reach the objective of tuberculosis eradication. Success stories such as that being enacted at the present time in Alaska with regard to the Eskimo population will help in changing this attitude, since startling reductions in tuberculosis have been accomplished in a short period of time in such instances without any major change in social and economic conditions.

Responsibility of the community with regard to infectious individuals has been rather well accepted, and is reflected in good case reporting, availability of free hospitalization, availability in many localities of free drugs when necessary, provision of com-

pulsory segregation when indicated and necessary, and so forth, although there are some geographical areas where considerable further improvement is needed. However, Dr. Soper's concept that the average citizen himself should be educated to accept responsibility on his own part for determining whether or not he is a menace to his fellow citizens, and willingly and voluntarily adhere to necessary measures if he finds he is a menace, is a new concept for which acceptance may be more difficult. Dr. Soper's suggestion of possible income tax or Social Security benefit to facilitate acceptance of such an attitude is certainly a novel idea, which however, I find rather difficult to consider as a realistic possibility. I do feel that it may be entirely feasible and desirable to induce certain individuals to complete an adequate period of drug therapy through some cash reward, such as a modest weekly compensation payable to the patient so long as he continues his drug therapy and reports regularly for supervision to an outpatient clinic or to his physician's office. Such compensation would be much less expensive than the daily cost of treatment in a hospital.

To prevent misunderstanding, let me stress here that I feel strongly that every patient with active tuberculous disease should have an initial period of hospitalization, but in most instances today this need be only for a few months of the total two years or so of drug treatment.

Dr. Soper has indicated the difficulties of a national plan and national coordinating authority in a country with a political structure such as the United States has, with sovereign rights of the individual states. However, it seems to me that the problem of tuberculosis is somewhat different from that of a disease involving an insect vector, and if we can educate, cajole, or bribe individual states to formulate and carry

out an adequate tuberculosis eradication program in conformity with and under the general guidance of an adequate national coordinating advisory group, I think the mission can be accomplished. With the close cooperation which already exists between the National Tuberculosis Association, the Public Health Service, and the Association of State and Territorial Health Officers, together with overlapping representation on the Tuberculosis Advisory Committee of the USPHS and the establishment of the new Tuberculosis Guidance Committee of the National Tuberculosis Association (with representation from its medical section, the American Thoracic Society, and the National Conference of Tuberculosis Workers), reasonably effective machinery is already available to formulate a realistic national plan for the eradication of tuberculosis.

As to the control of tuberculosis elsewhere in the world, both the World Health Organization and the International Union Against Tuberculosis have recently accepted the concept of elimination of tuberculosis as a public health problem, and later this can be extended to a world-wide program of eradication.

As to Dr. Soper's final point with regard to careful utilization of personnel and the use of specially trained non-professionals for certain tasks which at the present are performed by more highly trained individuals, we know from experience that this concept will also have some tough sledding in certain quarters. Yet the hard facts of the case are that there are not enough chest specialists, nurses, radiologists, and others—and never will be—to utilize only such highly skilled and trained individuals in all aspects of a tuberculosis control program, much less a tuberculosis eradication program. Careful experiments and demonstration have already indicated that many, although of course not all of the tasks performed by

these highly specialized individuals, can be carried on very adequately by intelligent individuals specially trained for their specific tasks, if it has been determined in advance precisely what they are to do, adequate training has been given them with regard to those particular tasks, and there continues to be

adequate supervision by the more skilled professional persons.

Dr. Soper's thoughtful and stimulating ideas deserve the careful consideration of everyone interested in the control of tuberculosis, and pose a tremendous challenge to all public health workers.

Dr. Perkins is managing director, National Tuberculosis Association, New York, N. Y.